NASA Langley's

NASA Langley's Advanced Actuators and Transducers

Hybrid actuator systems can recover environmental energy to power devices.

Actuators and transducers are deployed to harvest mechanical energy in the environment as electrical energy and to convert stored electrical energy into mechanical energy. By developing a transducer based on advanced electroactive materials, NASA has produced a design that can harvest orders of magnitude more energy in a given application than traditional solutions, yielding more power to drive devices and store in batteries. In a complementary effort, a hybrid actuator system (HYBAS) with both an electroactive polymer (EAP) and an electroactive ceramic (EAC) achieves enhanced displacement performance from a single power supply, greatly reducing electrical consumption while simultaneously improving mechanical displacement compared to current state-of-the-art actuators.

Benefits

- Low-volume, lightweight, high mechanical-to-electrical power conversion efficiency
- Superior performance compared to single-element designs
- Orders of magnitude more power than existing technologies and requires no power supply
- Custom design specifications possible due to configurable material selection
- Advanced materials to further enhance the system's characteristics

partnership opportunity

The Technology

High-performance electromechanical devices based on transducers and actuators are deployed in a wide variety of industries—the common need is a system that converts mechanical energy in the environment to electrical energy to power a device in the most energy-efficient process. NASA's technology applies a new design for improved performance and maintains the ability to capitalize on future gains from breakthrough materials. NASA's energy-harvesting transducer employs two materials in a unique configuration to greatly enhance the ability to extract energy from mechanical stresses, gaining tens to hundreds of times more output energy than traditional applications.

NASA uses both an active materials-based amplified mechanism and piezoelectric materials to efficiently harvest energy from environmental stresses such as common shocks and vibrations in shipboard or vehicular applications or from normal human walking. The device has a small physical footprint and low mass, allowing for integration into a number of systems where size is at a premium. Generated power could be simply stored in a battery or serve as a compact power source for wireless sensor networks for applications such as health monitoring, biomedical applications, and environmental safety alert systems.

The HYBAS design includes a dual piezoelectric transducer combining an EAP and EAC. The dual elements are powered by a single electrical source, reducing size and mass as well as the electrical demands of the system, as compared to single-element designs: hybrid actuator systems provide more potential and require less power. By controlling the thickness and distribution of power between the two elements, the HYBAS component can be custom-engineered to achieve optimal design specifications. This technology offers continued improvements as advanced materials are developed that can take advantage of the design configuration. Advanced displacement and reduced power consumption are widely demanded in electronic, electro-optical, micro-electromechanical, and mechanical systems for a wide array of applications, including optical devices, drug delivery, underwater navigation, and aerospace technologies.

Applications

- Actuators – precision machinery, optical devices, drug delivery, underwater navigation, microphones
- Aerospace – active noise-vibration control, aerodynamic control, surveillance
- Defense – surveillance, remote sensor networks, deploy actuators
- Mobile consumer electronics – power supplies
- Biomedical – power supplies and actuation for implants and wearable medical devices

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

The Technology Gateway

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LAR-17169, LAR-16698-1

Vol 1, Issue 47
NP-2008-04-77-LaRC